# Headway Science

## Teacher's Manual

Class 8

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## Lesson 1 : Crop Production and Management

A. Multiple Choice Questions (MCQs) :

1. (d) Fruits and vegetables
2. (c) Chenopodium
3. (d) Weeding
4. (b) South- western
5. (d) Animal and plant waste

B. Fill in the blanks :

1. sickle
2. kharif
3. leveled
4. carbohydrates
5. animal husbandry

C. State True or False :

1. False
2. True
3. True
4. True
5. True

D. Answer the following questions in short :

1. Crop rotation method involves growing of two different types of crops alternatively to replenish the nutrients in the soil . For example, Crop of wheat and rice which consume nitrogen are alternatively grown.
2. Ploughing improves the aeration of the soil.
3. Manure is an organic susbstance obtained from plants or animals waste, for example cow dung , urine , plant parts, vegetable or fruit peels, and other similar products. It made in the main field. It is rich in humus.
4. The harvested grains should not contain more than 14% of moisture or they may get infected with microbes and thus be damaged.
5. Kharif Crops : The kharif crops are summer crops , these are sown in the months of June or July and harvested in September or October every year. The kharif crops are dependent upon the South- Western

monsoons. Paddy, maize, soyabeans are few examples of kharif crops.

Rabi Crops : Rabi crops are winter crops. They are sown in the beginning of winter (October-November) and are harvested in March or April every year. These crops are not dependent on monsoons. Wheat, barley, oat, pea, and legumes are few examples of Rabi crops.

E. Answer the following questions in detail :

1. The grains are first dried in sun before they are to be stored. The sun dried food grains are then weighed, packed in gunny bags, then transferred to halls having proper ventilation called the godowns or granaries.

   The godowns must be made free of microbes, insects and rodents by spraying chemicals.

   The reserve stock is called the buffer stock, grain silos are specially designed metal tall cylindrical storage bins which can store food grains at different levels. There are openings in the silos through which the grains can be taken out from time to time.

2. Watering of crop plants is called Irrigation. It is an artificial application of water to the soil for the better growth of plants. In our country the farmers depend on the major source of water – that is rain. The amount of rain varies, is unpredictable, does not give right amount of water at the right time. Therefore, the farmers have to find out alternative source of water near their fields like tube-wells, rivers, lakes, ponds from where water is driven to the field through the canals. The amount of water supplied should be adequate amount as the excess of water harms the crops.

3. Soil Preparation : Soil anchors the roots of plants, provides nutrients and water to them and also provides oxygen to the roots. Loosening and turning of soil is called Ploughing or tilling of soil. Preparation of the soil

involves loosening and turning it.

Plough : Plough is used for tilling or scraping of soil. This is made up of wood and is drawn by a pair of bulls. Now a days tractors are used in place of animals.

Leveling : After ploughing, the soil is leveled i.e. pressed lightly with the help of a wooden plants or iron-leveller. This prevents erosion and water logging which aids in uniform irrigation.

Sowing of seeds : Once the soil is ploughed and levelled, the seed are sown in it. The process of putting seeds in the soil is called sowing.

4. Difference between manure and fertilizer

A. Manures

1. They are not nutrient specific.
2. They are not easily absorbed by the roots of the plants since they are not soluble in water.
3. They are organic substances.
4. They are difficult to store and transport.
5. They help in water retention since they restore the soil texture.
6. Since they are organic, exessive use does not harm the soil texture, provide humus to the soil.

B. Fertilizers

1. These are nutrient specific.
2. They are soluble in water and thus absorbed by the roots easily.
3. They are in organic substances.
4. They are in powered form, hence not bulky. They can be stored and transported easily.
5. They may damage the soil texture and make it more porous.
6. Excessive use can change the chemical

nature and composition of the soil, also pollute water.

5. Weeding : Wedding is process of removing weeds from the fields.

   Harvesting : The process of cutting and gathering of crops is called harvesting.

   Threshing : The whole process of separation of grains from the harvested crop is known as threshing.

   Winnowing : The process of separating grains from the chaff, with the help of wind is called winnowing.

## Lesson 2 : Microorganisms : Friends and Foes

A. Multiple Choice Questions (MCQs) :

1. (a) Edward Jenner
2. (d) Yeast
3. (b) Salt
4. (c) Communicable
5. (c) Fermentation

B. Fill in the blanks :

1. Viruses
2. 
3. Pasteurization
4. clostridium
5. Nitrogen

C. State True or False :

1. True
2. True
3. True
4. True
5. True

D. Answer the following questions in short :

1. The medicines used to kill or stop of disease causing organisms is called antibiotics.

   Eg- Streptoonycin , erythromycin.

2. A bacterium called Lacto bacillus, present in a spoonful of curd converts lactose of sugar present in the milk to lactic acid. This brings about the acidic medium in the milk for it to be coagulated.

3. Food preservation means longer retention of the nutritive value of perishable materials. The process of food preservation can be achieved by either killing the microbes or by preventing them to multiply.

4. Bacteria like Clostridium, botulinum and Staphyleooccus produce toxic substances causing food poisoning.

5. Viruses are extremely minute microscopic organisms and form a link between the living and the non-living beings as they show the characters of both living and the non living things. They are just like any non-livingsubstances outside the living cells but have the characteristics of living organism when inside a living cell(host).

E. Answer the following questions in detail :

1. The cyclic movement of nitrogen between living and non-living components of the earth is known as Nitrogen Cycle. Our atmosphere has 78% of nitrogen but the living organisms cannot take it directly from the atmosphere though all living organism require nitrogen as Certain bacteria-Rhizobium convert unusable form of nitrogen into compounds more easily usable by plants. Plants take in nitrogen compounds from the soil with the help of their roots to form proteins. Nitrogen enters the chain when consumers eat the plants. When the plants or animals die, the nitrogen present in the organic matter is released back into the sail or into the atmosphere.

2.

3. Bacteria like Clostridium, botulinum and Staphyleooccus produce toxic substances causing food poisoning.

   Many diseases are caused by bacteria in human beings like cholera, typhoid, tetanus, tuberculosis, diphtheria, pneumonia etc.

   Food is spoiled by the action of bacteria on it. For

example, rotting of potatoes, vegetables and fruits, souring of milk, petrification of milk etc.

4. Storing food at subzero temperatures in deep freezers or in cold storage at a temperature about - 18ºC is a safe method of food preservation for preserving fish, meat, fruits, vegetables. Deep freezing retains the flavour and freshness of food since it prevents bacterial growth and inactivates enzymes.
5. See Table on page 31.

## Lesson 3 : Coal and Petroleum

A. Multiple Choice Questions (MCQs) :

1. (c) Lignite
2. (c) Coke
3. (a) 100 $^{0}$C
4. (b) Compressed natural gas
5. (c) Hydrogen

B. Fill in the blanks :

1. Coal
2. Coal
3. Anthracite
4. Producer gas
5. natural, exhaustible

C. State True or False :

1. True
2. True
3. False
4. True

D. Answer the following questions in short :

1. The materials found in nature and used by living organisms for existence and survival is called natural resource.
2. The process of conversion of dead plants into coal is called carbonization.
3. When the dead remains of plants and animals are subjected to high temperature and pressure when buried inside the earth's crust over millions of years, fossil fuels are formed, namely coal and petroleum

(liquid petroleum or natural gas).

4. Fossil fuels are exhaustible natural resources as these resources once depleted can not be replenished back. It takes millions of year for the formation of fossil fuels. The rate at which we are using them is very fast compared to the rate of their formation.
5. We can follow the following measures to save energy.
    1. Soak pulses overnight or for some time before cooking and do cooking with covered vessels.
        * Try to use pressure cookers for cooking.
        * Use of electronic appliances should be used only when required.

E. Answer the following questions in detail :

1. Petroleum was formed from aquatic organisms living in the sea, when these organism died, their bodies settled at the bottom of the sea and covered with layers of sand and clay. As a result of bacterial action, decomposed organic matter got buried deeper and deeper. Over millions of years, absence of air, high temperature and high pressure transformed the dead organisms into liquid petroleum or crude oil and natural gas. Petroleum is generally found together with natural gas deep inside the earth's crust. Petroleum is obtained by drilling holes (oil wells) in the earth's crust. When a well is drilled, natural gas first comes out with great pressure and later oil comes out on its own and then it is pumped out.
2. Exhaustible Natural Resources :
    1. These are available in limited quantities.
    2. These take millions of years to form.
    3. These can be exhausted due to human activities if not used wisely.
    4. Example : Coal, petrol, natural gas etc.

Inexhaustible natural resources :

1. These are available in unlimited quantities.
2. May take less time than exhaustible resources to be formed.
3. These will not exhaust despite innumerable usage by human activities.
4. Example :- Sunlight, water, air etc.

3. Coal is used to produce steam, to rotate turbines in thermal power plant.

   It is used in extraction of metals.

   In earlier days, it was used in railway engines to produce steam to run trains.

   It is used as a source of organic compounds like benzene, toluene, phenol, analine and anthracene.

4. Petroleum is a mixture of hydrocarbons that have different boiling points, petroleum can thus be separated into its component or fractions by heating them to a temperature at which several fractions of compound evaporate. This type of distillation is called as fractional distillation. In industries, fractional distillation is performed in large, vertical cylindrical columns known as distillation towers or fractional columns In this process crude oil is heated to about 400ºC in a furnace and the vapours thus formed are passed into tall fractioning towers. The hydrocarbons with higest boiling points condense first are collected at the base of the fractioning tower. With the rising vapours the hydrocarbons with lower boiling points-condense till the crude oil is separated into different fractions. The gaseous hydrocarbons do not condense and escape from the top of the tower.

5. We can follow the following measures to save energy.

   1. Soak pulses overnight or for some time before

cooking and do cooking with covered vessels.

2. Try to use pressure cookers for cooking.
3. Use of electronic appliances should be used only when required.
4. Switch off lights, fans etc. when not in use.
5. Drive vehicles at moderate speed as far as possible keeping in mind the best fuel economy.
6. Switch off the engine while waiting or at traffic signals.

## Lesson 4: Combustion and Flame

A. Multiple Choice Questions (MCQs):

1. (b) carbon monoxide
2. (b) The inner most zone
3. (d) All of these
4. (c) CNG
5. (d) 47KJ/g

B. Fill in the blanks :

1. Explosive combustion
2. Middle zone of candle
3. flames
4. incomplete
5. insufficient

C. State True or False :

1. True
2. False
3. True
4. True
5. False

D. Answer the following questions in short :

1. LPG is better fuel for domestic use when compared with kerosene or wood as LPG does not release any harmful gases or smoke. LPG has a high calorific value.
2. The gaseous environment that supports combustion but does not itself burn is called supporter of combustion. Eg- oxygen, sulpher .

3. A combustible substance which on burning produces a large amount of heat and light is called a fuel. For example : wood, charcoal, petrol, diesel, kerosene, LPG (Liquified Petroleum Gas).
4. Dry wood catches fire easily as compared to wood having moisture because the moisture content prevents it from reaching the temperature required for combusting.
5. Water should not be used to extinguish electric fires as it may cause electric shook.

E. Answer the following questions in detail :

1. Rain-water when mixed with oxides of nitrogen and sulphur results in the formation of acid rain. Harmful effects of acid rain are:-

   . Acid rain destroys aquatic life like fishes, plants etc.

   . It causes loss of soil fertility.

   . Acid rain corrodes the buildings made with metals, marble etc.

2. Increase in the concentration of carbon dioxide in the atmosphere causes increase in temperature on the earth. Infrared radiations are trapped by carbon dioxide which results in heating up the atmosphere. This is called green house effect. Due to this - Melting of polar ice excessively resulting in the rise of level of water bodies like oceans and seas. The low lying areas get submerged and flooding of rivers takes place.

   Results in change in cropping pattern.

   Adversely affect the monsoon rains.

3. Outer Zone

   It is at the base of the flame. The wax vapourises due to heat. This gaseous hydrocarbon burns with a flame. The presence of air is sufficient in the zone to allow for complete combustion to take place.

Inner Zone : This zone is just above the outer zone which is formed by unburnt wax vapours given off by the molten wax. This zone is completely cutoff from the supply of air so no combustion takes place in this zone. It gives no light and is the coldest part of the flame.

Middle zone : Incomplete combustion takes place in this zone due to insufficient quantity of air. Unburnt carbon particles are present in the flame which when become very hot, give a yellow light.

4. Characteristics of a good fuel

A good and ideal fuel should have some properties which makes it a convenient fuel to be used. Some of the properties are as follows:-

1. It is should burn with moderate speed.
2. It should be cheap and economical, transportable and easily available.
3. It should be safe and be stored conveniently.
4. Should not burn with evolution of poisonous or irritating fumes or odours.

5. Ignition Temperature : The minimum temperature required to initiate burning of a substance is called as its ignition temperature. The substances which have low ignition temperature catch fire fast. Different substances have different ignition temperatures depending upon their chemical nature. For example, paper has lower ignition temperature than wood.

Objective : To demonstrate that a substance does not catch fire at a temperature below its ignition temperature.

Requirement : Paper cup, water, burner, triped stand, wire gauze, matchbox.

Procedure : Put a paper cup on a wire gauze on a tripod stand. Pour water in the cup. Place a burner

below the tripod stand and light it and observe.

Observation and conclusion : The water in the paper gets heated whereas the paper cup does not catch fire. The paper cup does not catch fire as it does not reach its ignition temperature. The water in the cup takes up the heat and prevents the paper to reach its ignition point, therefore it is not able to burn.

Conclusion : All the combustible materials have to reach to their ignition temperature to burn.

## Lesson 5 : Conservation of Plants and Animals

A. Multiple Choice Questions (MCQs) :

1. (a) Habitat
2. (c) 66
3. (b) IUCN
4. (d) All of these
5. (d) Vulnerable

B. Fill in the blanks :

1. wild animals
2. endangered
3. ecosystem
4. deforestation
5. migratory

C. State True or False :

1. False
2. True
3. True
4. True
5. False

D. Answer the following questions in short :

1. The Red Data Book is the state document established for documenting rare and endangered species of plants and animals that exist within the territory of the state or country. In this book, one is provided with central information for studies and monitoring programmes of rare and endangered species and their habitat.
2. Migratory birds fly hundreds and thousands of kilometers to find the best ecological conditions and

habitats for feeding, breeding and raising their young ones. When conditions and habitats for breeding sites become unfavourable, it is time to fly to regions where conditions are better.

3. 1. Kanha – Madhya Pradesh
   2. Jim Corbett Park – Nainital
   3. Gir – Junagarh – Gujarat
   4. Ranthambore – Rajasthan

4. The number and varieties of plants, animals and the micro organisms found on the earth is called the bio diversity. Bio diversity may be in the form, size, structure, habits, behavior and genetic constitution. Bio diversity is not uniformally distributed over the earth.

5. 1. Excessive grazing : It is due to increasing domestic population.
   2. Acid rain: Pollution of water bodies, aquatic plants and animals which ultimately bring acid rain.
   3. The commercial Exploitation: Unregulated commercial exploitation of wild life like wood, animals and their products is one of the main causes of their depletion.

E. Answer the following questions in detail:

1. Private rights are non-existent.

   Visitors are allowed to enter only to study, cultural and recreational purposes.

   Forestry operations, grazing of animals and hunting of animals are prohibited.

   Activities like fire wood collection, are strictly prohibited.

   Exploitation of habitat or wild life is prohibited.

2. Regulated and planned cutting of trees: This method involves cutting some trees in a particular area. Afforestation: It is a process of planting trees in the open areas so that it compensates the loss through

deforestation.

Special protected areas should be established like biosphere reserves, wild life sanctuaries and natural parks where rules should be followed strictly.

Public awareness and participation : The young growing plantation should be protected from overgrazing to maintain vegetation cover.

3. Wild life sanctuaries have the following features :-

1. The boundary of a sanctuary is not limited by state legislation.

2. The killing, hunting or capturing of any species is prohibited exept by or under the control of the highest authority in the department responsible for the management of sanctuary.

3. Forestry and other usages may be permitted but to the extent that they do not harm the wild life adversely.

4. In the absence of trees and their root system, the water is not able to seep into the soil. During rainy season, water just flows over the soil, bringing about floods.

Roots of the trees bind to soil and prevent the soil from blowing away by wind or water. Deforestation results in soil erosion. Erosion removes the to player of the soil that contains the fertile humus. Removal of top layer makes the soil less fertile. If this is allowed to go on, the fertile land gets converted into a desert. This process of conversion of fertile land into desert is called desertification.

5. A biosphere reserve is a multi purpose protected area for conservation of wildlife, plant and animal resources. Humans are important components of a reserve. Biosphere reserves provide areas for ecological and environmental research. In India, there are 14 biosphere reserves.

Biosphere reserves are developed to:

1. Maintain culture of that particle area.
2. To maintain ecological balance and conserve biodiversity.
3. To permit triblals and other people living in the area co- exist.

## Lesson 6 : Reproduction in Animals

A. Multiple Choice Questions (MCQs) :

1. (b) 40 weeks
2. (a) Elephant
3. (c) Testes
4. (a) Sperm
5. (a) binary fission

B. Fill in the blanks :

1. zygote
2. uterus
3. Placenta
4. reproduction
5. eggs

C. State True or False :

1. True
2. False
3. True
4. False
5. True

D. Answer the following questions in short :

1. Vas Deferens : The sperms which are produced in each of the testes travel upwards into the abdominal cavity through a duct called the was deferens or sperm duct.

   Urethra: Vas deferens passes the fluid contaiting sperms into urethra, on the way receiving secretions from accessory glands called the seminal, vesicles, prostrategland and the cowper's glands.

   Penis : Penis is a muscular organ and become stiff due to erectile tissues and blood spaces inside it. Penis helps to pass out urine and male gametes (sperms). The sperms are delivered into the vagina of the female.

Sperm : The sexual maturity in human males is attained around the age of 14 to 15 years. Sperms are produced in millions by the testes.

2. Asexual reproduction: the type of reproduction in which only one parent is involved and sex cells or gametes are not produced is called asexual reproduction.

   Sexual reproduction: the type of reproduction in which one male and one female parent is involved and fusion of gametes takes place is called sexual reproduction.

3. Reproduction is not a necessity for life, still it is the most important process as it is required for the continuity of species.

4. External Fertilization: The fertilization that takes place outside the body of an animal is referred to as External Fertiligation. In many aquatic animals like fish, star fish and frogs, fertilization is external.

   Internal Fertilization: This is an efficient form of reproduction. In this type of fertilization, the eggs remain inside the body of the females and the sperms are placed inside her body by the males. Fertilization takes place inside the body of the female. The full development of the embryo also occurs inside the female body. Internal fertilization occurs in insects, reptiles, birds and mammals.

5. In animals like frogs and insects like silk moth and butterfly, the young ones which are born (larva) look very different from the adult. These young ones(larvae) gradually mature undergoing a series of drastic changes that finally make them look like the adults. This called as Metamorphosis.

E. Answer the following questions in detail :

1. It is the simplest and fastest mode of asexual reproduction. It usually takes place under favourable

conditions. When one matured unicellular organism like amoeba splits into two daughter individuals, the process is called as Binary Fission. First the nucleus of the cell divides into two followed by the cytoplasmic division, thereby the cell splits into two daughter cells. Each of the newly formed offsprings get one nucleus. The daughter cell gradually develops and grows into a fully adult individual.

See diagram on page 87.

2. The zygote formed undergoes divisions of cells to form embryo. This gets attached to the walls of the uterus. This called 'implantation'. The developing baby is called embryo during the first weeks after fertilization. The embryo attaches itself to the uterus with the help of placenta. Placenta supplies oxygen, water, nutrients and hormones from the mother to the embryo. It gradually develops body parts. From eight weeks till birth, the developing baby is called foetus. The baby stays and grows inside the mother's womb (uterus) for about 40 weeks to develop fully. When the foetus is fully developed, the mother gives birth to the baby.

3. Ovaries : There are two ovaries in a female body each ovary has the shape and a size almost that of an almond. When a girl reaches puberty, the ovaries are stimulated by the pituitary gland to produce female sex hormone oestrogen.

   Fallopian Tubes : Fallopian tubes are called oviducts. This take up the ovum and transport it to the uterus.

   Uterus : Uterus is a muscular organ where the development of embryo occurs until the child birth in gestation period of nine months.

   Vagina : Uterus leads to a muscular tube called vagina. Vagina receives the penis during sexual intercourse.

See diagram on page 82.

4. Oviparous animals : Most animals lay eggs while some animals of give birth to young ones. Insects, frogs, elephant, dogs, snakes, turtles and birds lay eggs. Young ones come out from the eggs. In oviparous animals females lay fertilized/ unfertilized eggs. The development of zygote takes place outside the female body.

   Viviparous animals : Viviparous animals (females) give birth to young ones. The development of zygote takes place inside the body of female's body. Females deliver young ones and the chances of their survival are more. Example mammals.

5. Hydra is multicellular organism with a soft cylindrical body. It bears tentacles surrounding its mouth toward the top. A bud is a bulb-like projection on the body of the animal. During budding, the body develops some protuberances called buds. There are the developing new individuals arising from the parent body on the lateral side which are exactly similar to them in all respects. These may remain attached to the parent to form a kind of colony or may later after a certain period of growth, these buds detach from the parent body to develop into a new individual.

## Lesson 7: Reaching the Age of Adolescence

A. Multiple Choice Questions (MCQs) :

1. (b) Ovulation
2. (c) Thyroid gland
3. (d) Determination
4. (b) Pituitary
5. (d) XY

B. Fill in the blanks :

1. chromosomes
2. Puberty
3. ductless
4. Testosterone

C. State True or False :

1. True
2. True

3. True 4. False

D. Answer the following questions in short :

1. Puberty is the period in life at which sexually immature boy or a girl becomes sexually matured and capable of reproduction. Puberty ends when an adolescent reaches the reproductive maturity.
2. Secondary sexual characters appear In boys following are the secondary sexual characteristics which start appearing –

   . Elongation of hands and feet.

   . Growth of beard moustaches and pubic hair along with hair on chest and thighs also.

   . Growth of reproductive organs.

   . Voice becoming hoarse and deep. (cracking of voice)
3. A deadly disease called 'AIDS' is caused by a virus HIV (Human immunodeficiency virus). HIV causes AIDS, interferes with the body's ability to fight infections. The virus can be transmitted through contact with infected blood, semen etc. it can pass on from infected mother to baby.
4. Drugs are chemical substances which may affect the mental and physical behavioural changes in their body. Drug abuse may be defined as the use of drug for purposes other than medical use. The drugs are addictive and that once taken, it gradually becomes a habit and a tendency develops to take them again and again.
5. The period of life when the body undergoes transition from child into an adult is called adolescence. Since this period occurs in the boys and girls, this covers teens (13 to 18-19 years) and the adolescents are called teenagers.

E. Answer the following questions in detail :

1. The sex of the baby is determined by the type of sex-

chromsome inherited from the parents. The sex chromosomes determine the sex of the child. There are two types of sex chromosomes – 'X' chromosomes and 'Y' chromosomes. The female cell contains XX sex chromosomes whereas the male cell contains 'XY' chromosome. One of the chromosomes in a pair, either X and Y is derived from one parent and the second from the other parent. The sex of the child is solely dependent on his or her father. When an egg is fertilized by the sperm carrying 'X' chromosome i.e.'X' chromosome of mother and 'X' chromosome of father, the new born baby is a girl. On the other hand, if the sperm carrying 'Y' chromosome fertilize the egg, i.e. 'X' chromosome of the mother and 'Y' chromosome of the father, the new born baby is boy.

2. Pituitary Gland : It is located just below the brain, which is also called as hypothesis. It is commonly called as master gland and controls all other glands like thyroid gland, adrenal glands, testes, ovaries etc. Pituitary gland also secretes growth hormone required for the normal growth of a person.

   Thyroid Gland : Thyroid gland is attached to the wind pipe in the throat region. It secretes a hormone called the thyroxin. For the formation of thyroxin, iodine is necessary.

   Adrenal Glands : Adrenal glands are present, one each above the kidney. They secrete the hormone adrenalin in state of excitement, anger or fear etc. It regulates the heart beat, breathing rate, blood pressure, carbohydrate metabolism and mineral balance.

3. During adolescence or puberty, the ovaries enlarge and start producing mature ova. One of the ovaries produces and releases one ovum once in every 28-30 days. This is called ovulation. During this period of the

wall of the uterus becomes thick and gets ready to receive a fertilized egg, in case fertilization occurs. In case the ovum is not fertilized by a male sperm it dies and start disintegrating and the hormonal level drops. The lining of the uterus starts breaking down and is shed, accompanied by flow of blood. This phase is called girl's period or menstruation. Stoppage of menstruation is called menopause which is the termination of puberty. All these changes in female body are controlled by various hormones.

4. CHANGES DURING PUBERTY

1. Increase in Height : During puberty there is a sudden increase in the length of bones of legs and arms. Initially girls grow faster than the boys, but by the age of 18, both boys and girls reach their maximum height. The rate of growth varies in different sexes (i.e. boys and girls) and in different individuals.

2. Changes in body shape : Boys and girls during puberty start looking different due to certain changes, like the muscles of the body of boys grow and become more prominent.

Their shoulders become broad and chest wide.

. The region below the waist start becoming wider in girls. Their body grows to provide an hour-glass appearance due to the growth of the muscles.

3. Changes in voice Box and Voice : At puberty the voice-box or the larynx begins to grow. This is more prominent in boys and the larynx protrudes out in the throat region. This is called as adam's apple. In girls, the larynx is smaller, is hardly visible from outside. Boys develop deep hoarse voice while girls develop high pitched sweet voice.

4. Maturation of sex organs : At puberty, the sex organs in the body of girls and boys start becoming fully

developed. At puberty the male sex organs like testes, scrotal sacs, penis become fully developed in boys. Testes start producing sperms.

## Lesson 8 : Force and Pressure

A. Multiple Choice Questions (MCQs) :

1. (a) Newton
2. (c) Magnetic
3. (d) Mechanical force
4. (d) All of these
5. (b) Decreases

B. Fill in the blanks :

1. Force
2. Gravitational force
3. contact
4. Speed, direction
5. equal

C. State True or False :

1. False
2. False
3. True
4. True
5. True

D. Answer the following questions in short :

1. Contact Forces: The forces that act only when there is physical contact, direct or indirect between the objects are called the contact forces. Ex- Muscular Force, Frictional Force.

   Non- Contact Forces : forces that can act on an object if when the objects are not in contact. These forces are called as Non-Contact Forces. For example, gravitational force, magnetic force and electrostatic force.

2. The force acting on a unit, area is called pressure. It is denoted by 'P'.

   Force (F) = Pressure /Area(A)

   Pulling force of the earth is called the force of gravity or the gravitational force. Actually all objects in the universe exert a force on one another due to their

masses.

3. The effect of force or pressure depends upon.

. The magnitude of the force applied, i.e. greater the magnitude, more is the effect of force.

. The area over which the force is applied, i.e. bigger and area on which the force is applied, lesser will be the effect the force.

4. The weight of the atmosphere exerts a pressure on the surface of the earth. This pressure is called the Atmospheric Pressure.

5. The force exerted by a magnet is called the magnetic force. Since, it can exert force from a distance on another magnet or an iron object without being in physical contact with them, it is called as Non-Contact-Force.

E. Answer the following questions in detail :

1. Objective : To demonstrate that the liquids exert pressure on the sides of the container.

Procedure : Take an empty plastic bottle or a cylindrical container. Drill four holes all around near the bottom of the bottle. Close the holes with tape. The holes should be at the same height from the bottom. Now, fill the container with water. Now remove the tapes. You will observe that the water gushes out the container. The water comes out with the same force from all the holes. The pressure of water exerts pressure on the sides of the container from all sides.

2. Effects of Force

1. Force is applied to change the shape of an object : The shape of the rubber band changes when it is pulled.

2. Force is applied to move an object from one place to another, i.e. move from position or rest: A book or a round rubber ball is at speed zero and it will remain so if

it is not disturbed.

3. Force is used to change the direction of a body in motion: when a batsman hits a ball with his bat, he applied force to change the direction of the motion.

4. Force can change the speed of a moving object: For example, a player can change the speed of a moving football by kicking it in the direction of its motion.

3. 1. Frictional Force: The force acting between any two surfaces in contact and tend to oppose motion is called the force of friction. If a ball is rolled on a rough road, it stops after moving across a short distance. Now, roll it on a smooth floor of a room. It moves through a much longer distance and comes to a rest. The moving ball stops because of the existence of force due to the roughness of the force.

2. Magnetic force : Magnets are differently shaped and sized. Iron objects which have magnetic force of attraction i.e. they attract iron pins, nails etc. They attract the unlike poles of magnets and repel the like poles. Magnets exert force from a distance. The force exerted by a magnet is called the magnetic force. Since, it can exert force from a distance on another magnet or an iron object without being in physical contact with them, it is called as Non-Contact- force.

4. Objective : To show that the air exerts pressure.

Procedure : Pour some water in a tin can with its mouth open. Boil the water in can for a few minutes the steam produced drives out the air from the can. Now, close the mouth of the can with a lid tightly and pour cold water over it.

Observation : It is observed that on pouring cold water over the can, it get crushed from all the directions.

Conclusion : It is because on pouring cold water, the

steam inside condenses, creating a partial vaccum inside the can. This is due to the pressure of the air from out side which exerts pressure on the walls of the can and crushing the metallic can. This shows that the air exerts pressure.

See diagram on page 118.

5. Pressure is force per unit area.

   $P = F/A$

   Camel has broader feet and thus walks easily in sand of the desert as compared to horses or donkeys.

## Lesson 9 : Friction

A. Multiple Choice Questions (MCQs) :

1. (c) Graphite
2. (a) Contact force
3. (b) Reduce friction
4. (a) Limiting friction
5. (b) Drag

B. Fill in the blanks :

1. increases
2. mass
3. static
4. mountaineers
5. heat

C. State True or False :

1. True
2. False
3. False
4. True
5. True

D. Answer the following questions in short :

1. When the applied force is increased further, the body begins to move in the direction of the applied force. When the body is just beginning to move due to maximum force applied, it is called the limiting friction.
2. A surface looks smooth to our naked eye. If seen through a powerful microscope, the surface appears to be full of irregularities in the form of tiny hills and

valleys. More is the roughness of the surface, more will be the friction. When the two surfaces come in contact with each other, the get interlocked. The interlocks get broken down when sufficient force is applied and so the body begins to move.

Therefore friction depends on the nature of the surfaces i.e. smoothness or roughness of surface.

3. The force which always opposes the motion of one body over the other body in contact with it, is called the Frictional Force.
4. The force of friction has the following properties :

   1. Friction is a force that always oppose motion that is it slows down and stops a moving object.

   2. Friction always products heat.
5. Fluid friction is a force that acts between layers of fluid restricting the movement.

E. Answer the following questions in detail :

1. Construction : Spring balance is a kind of simple machine to weigh objects manually (by hand). It has a high tension steel spring enclosed in a metal casing having a split throughout its length. The upper end of the spring is wielded to the top of the metal casing whereas the lower end is attached to a strip of steel. A hook is fixed at the lower end of the trip. A small pointer is attached at the junction of steel strip and the spring.

   A scale is caliberated in gram force (gf) or kilogram force (Kgf) on the metal casing on the front. The spring is free to move along the scale.
2. Advantages of friction are :

   1. Friction between our feet and the ground enables us to walk.
   2. The friction between the wheels and the brakes

slows down or stops the motion of vehicle.

3. We cannot hold a pencil or any other object in our hand without friction.
4. Friction is necessary for doing things like lighting a matchstick. The rough surface of the match box when struck with the match stick creates friction to light it up.

3. Types of friction : On the basis of its nature, frictional force can be divided into three types :

   1. Static Friction
   2. Sliding Friction
   3. Rolling Friction

   1. Static Friction : When a force is applied on an object to move it and it does not move, the force applied is balanced by the force of friction. This is called static friction. It is the force acting between two surfaces when they are not moving relative to each other, even when an external force is applied on them.

   2. Sliding Friction: The minimum force required to make a body just to slide over the surface is equal to the sliding friction. It is the force acting between two surfaces when the object slides on another object.

4. By using ball bearings: Ball bearings are small steel or lead balls introduced in between the two moving surfaces to reduce friction. Ball bearings change the sliding friction to rolling friction.

   By using lubricants : The use of lubricants remove the unevenness of the two surfaces in contact, by forming a thin smooth layer between them. The bearings and other parts rubbing on one another are greased to reduce friction.

5. 'Friction is a necessary evil' since along with many advantages, it imparts the following disadvantages also.

. Friction opposes motion and stops moving objects.

. Machine parts get heated up due to friction and thus get damaged. There is wastage of energy and fuel. Due to this, they have to be replaced or repaired from time to time. . Since friction causes wear and tear of the moving parts, it reduces the efficiency of machines.

## Lesson 10 : Sound

A. Multiple Choice Questions (MCQs) :

1. (a) frequency
2. (c) medium
3. (d) flute
4. (b) brain
5. (d) wood

B. Fill in the blanks :

1. hertz
2. vacuum
3. vibrates
4. Larynx
5. Fastest

C. State True or False :

1. False
2. True
3. False
4. True
5. True

D. Answer the following questions in short :

1. Pitch of the female voice is higher than the male voice as the voice of woman has a higher frequency and is shriller than the voice of man.
2. Noise

   1. It is an unpleasant and unwanted sound.

   2. There are sudden and arbitrary changes in amplitude and frequency of sound.

   3. Produced by irregular vibrations.

   4. No practice is required to produce noise.

   Musical Sound

   1. It is a pleasant sound .

2. There is no abrupt or arbitrary changes in amplitude and frequency.

3. It is produced by systematic vibrations.

4. Practice is required to produce musical sound.

3. Maximum or extent of vibration or oscillations of a vibrating body from its mean position is known as its amplitude. It is the greatest distance that a sound wave moves up and down.

The number of oscillations or vibrations made by an object in one second is called the frequency of oscillations. The SI unit of frequency is hertz (Hz) andits symbol is 'f'.

4. Some of the sources of noise pollution are :

Rail Traffic : IT affects mostly people living near the railway line.

Air traffic : Aeroplane engines generate a lot of noise. People in the near by areas of airports have to suffer from the noise of flying airplanes constantly.

Industries : People living in the neighbouring areas of the noisy manufacturing plants can be disturbed constantly due to noise pollution.

Consumer Products : Certain household appliances like mixer grinder, vacuum cleaner, coolers, T.V. Radio etc. my cause high BP, headache, hearing problems to the residents.

5. Pitch of the sound depends on frequency.

E. Answer the following questions in detail :

1. Objective : To demonstrate that sound travels through liquids.

Procedure : Take a bucket and fill it with water. Put a bunch of keys in it. Sit in a position. Hold the key bunch in one of your hands and take it inside the water in the bucket. See that your hand or the keys do not touch

the sides or the bottom of the bucket. Now bend down your head so that one of your ears is just touching the water in the bucket. Take care that the water does not enter your ear. Gently shake the key bunch inside water in the bucket. Can you hear the sound of the keys? It is loud and clear. The reason is, shaking of the keys causes disturbance in the water in the bucket.

Conclusion : It is verified thus that the sound travels through liquids.

2. Following are some measures to reduce noise pollution.

. Quieter engines should be designed to reduce vibrations.

. Silencing devices must be installed in aircraft engines and transport vehicles.

. Electric generators and other noisy electric appliances should be equipped with silencers.

. Playing very loud music in cars, buses and trucks should be banned.

. Factories should be located in areas away from the residential areas.

. People should be advised to play televisions, music system, radios etc. at low volume.

3. The outer car: The human ear is made up of three different parts, the outer ear, the middle ear and the inner ear.

The Outer ear :The outer ear which is funnel shaped is called 'Pinna'. Its main function is to collect the sound waves. The sound waves then travel through the ear canal to the ear drum. The ear drum vibrates due to the incoming sound waves and transmits these vibrations to the middle ear.

The Middle Ear : The function of the middle ear is to convert these sound waves into vibrations. For this it

has a thin membrane stretched tightly at the end of the canal. This is called the ear drum. The sound waves strike the eardrum (tympanic membrane) which starts vibrating. These vibrations are transmitted to three small bones, hammer, anvil and stirrup acting as levers. These amplify the sound several times.

The Inner Ear : The vibrations are passed on to the parts of inner ear, semicircular canals and cochlea. The fluid filled in these vibrates and affects the auditory nerve which reaches the brain and thus we 'hear'.

4. The organ that is involved in the production of sound in humans is the larynx or the voice box. The Voice box is situated in the neck at the upper end of the wind pipe or trachea. Two vocal cords are stretched cross the voice box. A narrow slit is present between the vocal cords for the passage of air. When the lungs push the air through the slit. The vocal cords vibrate to produce sound. The tighter the vocal cords, the more rapidly they vibrate and higher are the sounds produced.

## Lesson 11: Chemical Effects of Electric Current

A. Multiple Choice Questions (MCQs):

1. (d) None of these
2. (a) petrol
3. (c) Chlorine Gas
4. (a) anode
5. (b) Electrodes

B. Fill in the blanks :

1. Pure water
2. Tap water
3. transformation
4. weak
5. destroyed

C. State True or False :

1. True
2. False
3. False
4. False
5. False

D. Answer the following questions in short :

1. Good Conductor: Materials which allow electricity to pass through them are called as good conductors. For example – copper, aluminium are two good conductors of electricity.

   Bad conductors or poor conductors of electricity: Material which do not allow electric current to pass through them easily are poor conductors of electricity or insulators. For example – wood, rubber and plastic, etc.

2. The ordinary metal has a very thin covering of gold to make it look more attractive and expensive at a reasonable price. For example, a brass bangle may appear to be made of pure gold since it is gold plated. The article to be electroplated is made the cathode in this process (negative electrode) and the metal which has to be coated is made the anode (positive electrode). The electrolyte is generally the salt solution of the metal to be coated. On passing the electric current, the article gets coated with the desired metal.
3. Wet hands has a lot more conductivity than dry hands, thus touching electrical appliances with wet hands should be avoided.
4. LED glow seven when a very small current flows through it. LED has two wires called leads attached to it. One is longer, than the other. The longer lead of LED must be connected to the positive terminal of the battery and the shorter one should be connected to the negative terminal.
5. Zinc is collected with iron to protect it from rusting. This process is called galvanization .

E. Answer the following questions in detail:

1. Objective : To demonstrate the electrolysis of sodium chloride (common salt)

Procedure : Take beaker, two carbon rods, a plastic sheet and 9V battery. Make a strong solution of common salt and pour it into the beaker. Now put two carbon rods and a plastic sheet. Connect the carbon rods to the terminal of a 9V battery with a plug key in between. Plug in the key and let an electric current flow through the salt solution.

Observation : It will be observed that gas bubbles are released from both the carbon electrodes.

Conclusion : The gas formed at positive electrode is chlorine gas and the gas collected at negative electrode is hydrogen. Sodium Hydroxide is also formed.

2. Electrolyte (solution) must contain ions of the metal to be electroplated on the article i.e. should be suitable salt of the electroplating material.

. Article to be electroplated is cleaned thoroughly.

. Article to be electroplated should be made the cathode.

. The metal to be plated on the article is to be made the anode.

. Connect the anode to the positive (+) terminal of the battery and cathode to (-) terminal of the battery.

. A low current and for a longer duration should be passed.

. Direct current and not A.C. should be used.

. A their layer of the pure metal is deposited on the article.

3. Objective : To shows that water is made up of hydrogen and oxygen.

Procedure : Take beaker in which two inverted test tubes A and B are arranged as shown in the figure. Two ends of copper wires, one each in test tubes A and B are placed. The other end of the wires are attached to the

two terminals of the battery with a key on the way. Fill the test tubes and the beaker with water. Add a few drops of dilate sulphuric acid in water to make it an electrolyte .

Observation : On passing current from the battery, bubbles are seen to evolve in water in both the test tubes. The respective gases in test tubes A and B start collecting above water level by downward displacement of water. After some time, it is observed that gas collected at cathode (test tube B) is double in volume than the gas by anode (test tube A) i.e. in the ration of 2:1.

After the test tubes are totally filled with gases, remove them and close their mouth with corks. It is observed that the gas burns with a small pop sound (explosive) in test tube B when a burning match stick is brought near the mouth of it. The flame is seen to burn vigorously in test tube A.

Conclusion : This shows that water (acidulated) chemically break by passing electricity into hydrogen and oxygen in the ratio of 2:1. This can be represented by the following equation.

See equation and diagram on page 157.

4. LED is a widely used source of light in electrical equipment . LED glow seven when a very small current flows through it. LED has two wires called leads attached to it. One is longer, than the other. The longer lead of LED must be connected to the positive terminal of the battery and the shorter one should be connected to the negative terminal.

5. Tester is a simple application which is used to check whether an electric current is passing through a particular material.

We can also make a tester using battery, wires and an

electric bulb to test if electric current is passing or not. To make a tester we connect a battery and an electric bulb in series using electric wires. Free ends of the connecting wires may be used to test the conductivity of liquids.

The tester should be checked before using it. For that, join the free ends of the tester for just a moment.

. If the bulb glows, tester is working.

. If the bulb does not glow, it shows the tester is not working. The possible reasons may the following.

. Bulb is fused

. The connections are loose

. Battery is discharged

## Lesson 12 : Some Natural Phenomenon

A. Multiple Choice Questions (MCQs):

1. (a) comb
2. (a) Positive Charge
3. (a) Must be negative
4. (a) focus
5. (c) both (a) and (b)

B. Fill in the blanks :

1. continuously
2. negative
3. repulsion
4. plate boundary
5. lightning

C. State True or False :

1. False
2. False
3. False
4. True
5. True

D. Answer the following questions in short :

1. Check to see if your house is bolted to its foundation otherwise they are likely to be severely damaged during earth quakes.

   If you are indoor during earthquake get under table.

Hold on to one of legs and close your eyes.

It is dangerous to run outside when earthquake happens bricks, roofing and other material may fall and injuring people.

If you must leave the building after the shaking stops, use the stairs and not the elevators.

If your are in a car or a bus, do not come out. Ask driver to drive slowly to a clear spot.

2. When a charged body is brought near an uncharged body It induces an opposite charge on the uncharged body.
3. The electricity does not flow continuously and therefore it is called as static electricity.

   Eg- Attracting small bits of paper by comb ( rubbed by hair).
4. Electric discharge can take place between a charged cloud and earth or a tall tree, tall building etc. On the earth high buildings or trees may acquire opposite charge if charged cloud passes across them. If the charge is too huge, it may cause shattering or burning of the building.
5. The attraction between two bodies may be due to oppositely charged body or an uncharged body. But repulsion is only seen when both the bodies have similar charges. Thus, we understand that repulsion is a sure test that a body is charged.

E. Answer the following questions in detail :

1. Franklin (1752 in America) used silk cloth kite and tied a metallic key to the silk thread. He received and electric shock when ever there was a flash of lightning in the clouds. The key also got warned up. From this experiment Franklin understood that the clouds get electrically charged during rainy season. On touching

the metallic key, he received the charge passing it to the earth. This explained why Franklin got electric shock. He determine cause of lighting .

2. Objective : To show that similar charges repel each other.

Procedure : Cut two 2.5 x 5 cm pieces from an empty plastic bottle. Make one hole near one end of each plastic piece, so that a thread can pass through it. Pass a cotton thread each, through the holes of both the pieces and hand them on an iron stand in such a manner that the two pieces are not one inch from each other. Rub each of the plastic piece with a polyester cloth, one by one. Then leave them to suspend freely.

Observation : The two plastic pieces repel and move away from each other. Take care that you do not touch the plastic pieces directly with your fingers during or after rubbing them.

Explanation and Conclusion : Since, the two plastic pieces are of the same material and have been rubbed with the same polyester cloth, they acquired the same type of charge on them so they repel. Therefore, we can say that similar charges repel each other.

Objective : To demonstrate that unlike charges attract each other.

Procedure : Suspend a dry plastic straw with a thread, on a stand. Hold one end of the straw and rub its other end with a piece of dry polyester cloth. Immediately hold the cloth piece close to the rubbed end of the straw. Do not touch the rubbed part of the straw or the rubbed piece of cloth. Other wise the charge on the straw will flow out through your body.

Observation : You will observe that the straw were rubbed with each other, they must have acquired equal and opposite charges. Explanation and Conclusion :

Unlike charges attract each other.

3. There is a hot magma below the earth's crust which has about 20 plates called the tectonic plates. These plates are in relative motion to each other because they float over the hot magma below. These plates may collide or slip over each other, or interlock and get stuck due to which pressure is built up to rip up the plates apart in years. The rocks crack and shift, produce shock waves of energy in all directions. Earthquakes are felt when these waves reach the surface.

4. The electroscope which is used uses gold leaves for detecting an electric charge and thus it is called as Gold Leaf Electroscope. A gold leaf electroscope consists of a larger jar with wooden base. The lower portion of the jar's inner wall is lined with a thin tin foil. A metal rod is fitted into the mouth of the jar with the help of a cork. At the lower end of the metal rod, a pair of the thin gold leaves is suspended.

   . To detect and measure the charge on the object

   . Touch the body to be tested with the metal disc of an electroscope. If the gold leaves remain unaffected, the body has no charge. The extent of divergence of the leaves is a measure of the charge on the body. A body carrying higher charge will cause greater opening up of the leaves. To find out the nature of charge on an object charge the electroscope with a known charge.

5. FACTORS CAUSING EARTHQUAKE

   1. Volcanic Eruptions : A Volcano is a forceful gushing out of hot mother rocks and hot gases under great pressure through an opening in the earth's crust. The energy causes vibrations in the earth's crust at the time or before the earthquakes.

2. Dislocation of Earth's Crust : Faults' are the terms related to a kind of fracture in the earth's crust when two

adjacent rocks slips. Dislocation of crust thus takes place which results in earthquakes of great destruction.

3. Man Made Explosions: Practices like mining, blasting of rocks with the help of dynamite, various kinds of nuclear explosions also result in vibrations in the earth's crust of high magnitude.

## Lesson 13 : Light

A. Multiple Choice Questions (MCQs):

1. (c) Kaleidoscope
2. (d) Real
3. (b) Normal
4. (a) Reflection
5. (a) Blind

B. Fill in the blanks :

1. reflected ray
2. cornea
3. red
4. Myopia
5. 25 cm

C. State True or False :

1. True
2. False
3. True
4. False
5. True

D. Answer the following questions in short :

1. Type of reflection where reflected rays of light follow a uniform direction is called a Regular Reflection.

   When light falls on a rough surface they get reflected in different directions giving a hazy kind of vision is called Irregular vision. In case of diffused reflection from a rough surface, either there is no image formed or a blurred (hazy) image is formed.

2. First Law of Reflection: The incident ray, the reflected ray and the normal ray travelling to the reflected surface at the point of incidence, all lie in the same plane.

   The Second law of Reflection: The second law of reflection states that the angle of incidence is equal to the angle of reflection.

i.e. $\angle i = \angle r$

3. In dark there is no sufficient light to get reflected back from an object, so we can not see in dark.
4. A real image can be obtained on a screen. Real image is inverted.

   Virtual image cannot be obtained on screen. Virtual image is erect.
5. Myopia: a defect of vision in which a person can see the nearby objects clearly but cannot see the distance objects clearly.

   Hypometropia :a defect of vision in which a person can see the distant objects clearly but cannot see the nearby objects clearly.

E. Answer the following questions in detail :

1. Take three thin strips (15 cm x 5 cm) of mirror and fix them to form a triangular tube using an adhesive tape. Use a triangular transparent glass/plastic piece to close one of the ends of the triangular tube. Cover the triangular tube with card sheet rolled over in such a manner that the triangular tube is about 0.5 cm inside from one of the ends of the card sheets. Next, place some coloured broken glass or plastic pieces on the transparent glass cover of the triangular tube. Cover this with another glass piece and paste it firmly to the outer card sheet jacket. Close the other end of the card sheet jacket with a thick paper. Make a peep-hole in its centre. The Kaleidoscope is ready.
2. The process of splitting of white light into its seven colours is called as dispersion of light. The band of colours produced when white light is split up is called the spectrum. The spectrum has seven colours– violet, indigo, blue, green, yellow, orange and red. This is called VIBGYOR.

   Objective : To observe VIBGYOR through a prism

Procedure : Let a beam of light (sunlight) fall on one of the faces of transparent glass prism. Let the emerging beam fall on a white sheet of paper placed opposite to the other side of the prism. A beam of seven different colours is seen to fall on the paper. The colours is seen to fall on the paper. The colours are in the sequence of VIBGYOR making a spectrum.

Explanation : The light of different colours travel with different speeds. The violet light travels slowest and the red fastest. So, the red light bends least andviolet the mot mentioned earlier. Dispersion is due to the refraction of different colours at different angles Issac Newton obtained spectrum of sunlight first. Rainbow is formed due to just after rains, due to the refraction of sun rays through suspended rain drops which act as little prism.

3. Objective : To prove the laws of reflection

Procedure : Take a cardboard sheet. Make a slit of mm width in it. Make the card board stand vertically on a piece of white sheet spread on a table. Place a plane mirror in front of the slit at a distance on the white sheet vertically. Darken the room and throw torch light into the slit.

You will see a ray of light coming from the slit, striking the surface of the mirror. Mark the path of this ray with points or crosses on the white sheet. You will also see another ray emerging from the point of incidence on the mirror. Mark the path of this ray with points or crosses on the white sheet. Mark the position of the mirror also as shown in the figure.

Figure pg 182

In the figure AO is the incident ray, OB, the reflected ray and PQ the position of the mirror. Remove all the things from the white sheet, join all the points, Draw a

perpendicular at the point O, the point of incidence of the incident ray. This is called Normal.

You will find that the angle of incidence AON and the angle of reflection NOB are equal. You also observe that the incident ray, the normal and the reflected ray, all lie at the same plane. Thus proving the laws of reflection.

4. The image of an object does not vanish immediately from eye, even after the object in front of our eyes is removed, it stays there for about 1/16 of a second. So, images that are observed in quick succession do not appear as separate images, rather they look like smooth moving animations. This phenomenon is called 'Persistence of vision'.

ACTIVITY

Objective : To demonstrate the phenomenon of persistence of image.

Procedure : Take a round piece of paper card. Make two holes opposite to each other and thread a string through the two holes. Draw a picture of a bird on one side and a cage on the other side of the paper. Hold and twist the strings to twist the paper rapidly. Observe carefully .

Observation and Conclusion : When the paper card twists rapidly, it is observed that the bird is in the case. This happens due to persistence of vision.

5. The Braille system involves a method using special symbols representing the alphabets and their combination. The symbols consist of up to six dots, two dots horizontally and 3 dots vertically in a rectangular array.

The dots are slightly raised (embossed) above the surface of the paper. The sear ray of raised dots is called a Braille cell. This six dot code system is used by blind people by gliding fingers across these raised dots.

13

# Light

The world around us is full of beautiful things, things which are important to us, things which may not be so important to us. The world is largely known through our senses. The sense of touch, hearing, seeing makes us aware of things around us. The sense of sight is one of the most important senses. Through it we see Mountains Rivers, tree, plants, furniture, people and so many other things. We also see clouds, rainbow and the birds flying in the sky. At night we can see moon, stars. We can read or enjoy drawing printed on the paper because of our sense of sight.

## *What makes thing's visible?*

*We may say that our eyes make us see things. But can we see things in darkness? Therefore, it is understood that eyes alone are not capable of the sight. It is only when light falls into our eyes emitted by an object or may have been reflected by it, that we are able to see.*

## Reflection of Light

Rebounding of light from a surface is called reflection of light. Depending upon the nature of the materials, the objects are grouped as transparent, translucent and opaque objects.

Materials which may be highly polished and smooth which reflect back almost all the light falling on it are reflectors. For Example, A plane mirror, a stainless steel surfaces.

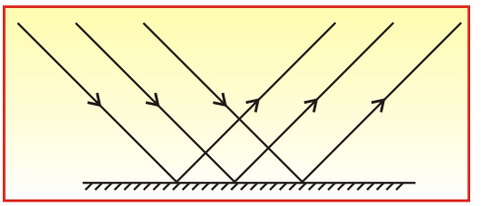
Materials which allow almost all the light to pass through them, they are called they are called as transparent materials. They may allow a very little amount of light to be reflected back. For example, glass, clear water etc.

Materials which reflect some of the light and absorb remaining light are called as opaque materials. For example: Cement wall, stone, etc.

## REGULAR AND IRREGULAR REFLECTION

### Regular Reflection

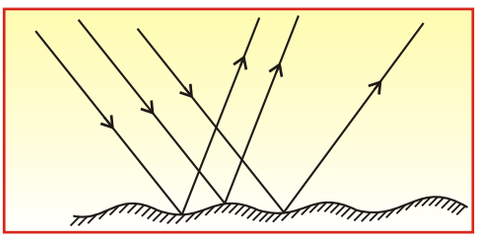
Most of the surfaces on which light falls are not perfectly smooth. Some objects have smooth surface, some very smooth and some are rough while some are very rough. Irrespective of the nature of the surfaces all opaque objects reflect the light falling on them. But the nature of reflection and the path of reflection of light differs. Most of the surfaces on which light falls are not perfectly smooth. However, if the surface of an object is actually smooth like the mirror or the metallic surface, the beam of light that falls on it, is totally reflected back in one direction only. Well defined images are formed due to regular reflection, as in case of plane mirror. This type of reflection where reflected rays of light follow a uniform direction is called a Regular Reflection.



*Plane mirror*
*(Regular Reflection)*

### Irregular Reflection or Diffused Reflection

It is our day to day life that our rooms are lighted during the day time even when direct sunlight does not fall on it. This is because of diffused reflection or irregular reflection of light. When light falls on a rough surface they get reflected in different directions giving a hazy kind of vision is called Irregular vision. This usually happens when our rooms are lighted during the day time but direct sun light does not fall on it. In case of diffused reflection from a rough surface, either there is no image formed or a blurred (hazy) image is formed.

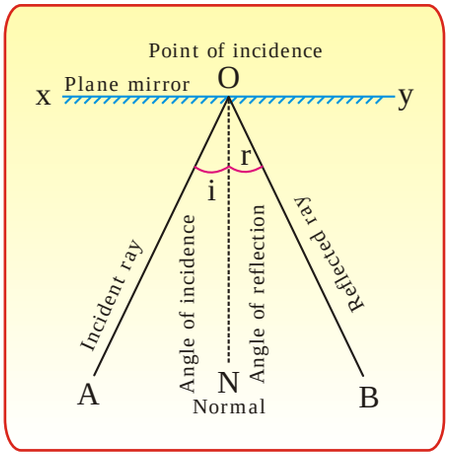


*Rough surface*
*(Irregular reflection)*

### Terms related to Reflection

When ray of light falls on a smooth surface it returns back in the same medium as shown in the figure below.

In this figure :




- AO is the ray falling on a smooth surface XY. It is the incident ray. A ray which falls on a reflecting surface of a mirror is called incident ray.
- OB is the ray reflecting from the smooth surface XY. It is the reflected ray. A ray which returns back into the same medium after reflection is called reflected ray.
- O is the point where the incident ray strikes. This is the point of incidence.
- ON is a perpendicular drawn at point O. It is normal. An imaginary line drawn perpendicular to the plane surface of mirror is called Normal.
- ∠ AON is the angle of incidence. The angle formed by the incident ray and normal is called the angle of incidence. It is denoted by 'i'
- ∠ BON is the angle of reflection. The angle formed by the reflected ray and the normal is called the angle of reflection. It is denoted by 'r'

## Laws of Reflection

The returning of a ray of when it strikes a polished surface in accordance with certain definite laws is called the laws of reflection.

There are two laws of reflection :

**First Law of Reflection :** The incident ray, the reflected ray and the normal ray travelling to the reflected surface at the point of incidence, all lie in the same plane.

**The Second Law of Reflection :** The second law of reflection states that the angle of incidence is equal to the angle of reflection.

$$\text{i.e.} \angle i = \angle r$$

The law hold good for all reflecting surfaces either plane or curved. In case of reflection of light, when a ray of light falls normally or perpendicularly on the surface of the mirror, the angle of incidence and the angle of reflection is equal to zero

$$\angle i = \angle r = 0$$

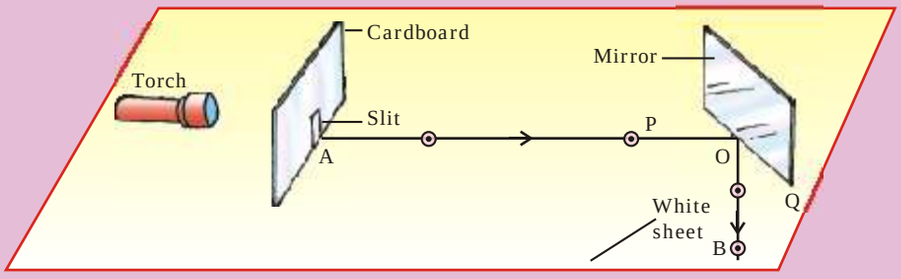
Due to this, the light ray retraces its path.

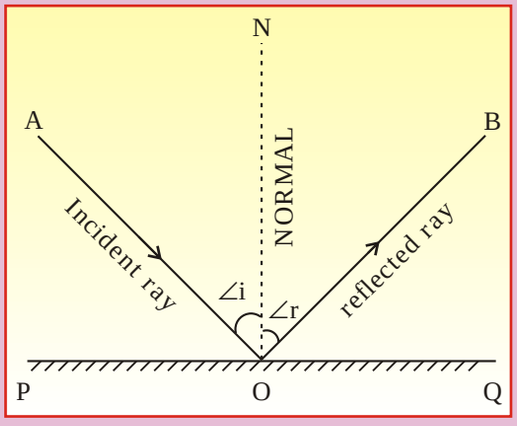
## Activity :

*Objective :* To prove the laws of reflection

*Procedure :* Take a cardboard sheet. Make a slit of mm width in it. Make the card board stand vertically on a piece of white sheet spread on a table. Place a plane mirror in front of the slit at a distance on the white sheet vertically. Darken the room and throw torch light into the slit..

You will see a ray of light coming from the slit, striking the surface of the mirror. Mark the path of this ray with points or crosses on the white sheet. You will also see another ray emerging from the point of incidence on the mirror. Mark the path of this ray with points or crosses on the white sheet. Mark the position of the mirror also as shown in the figure.



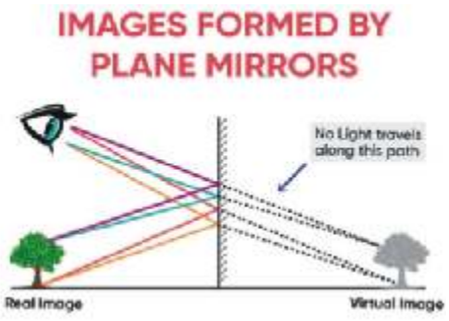




In the figure AO is the incident ray, OB, the reflected ray and PQ the position of the mirror. Remove all the things from the white sheet, join all the points, Draw a perpendicular at the point O, the point of incidence of the incident ray. This is called Normal.

You will find that the angle of incidence AON and the angle of reflection NOB are equal. You also observe that the incident ray, the normal and the reflected ray, all lie at the same plane. Thus proving the laws of reflection..

## Image formed by the plane mirror

When the object is held in front of the mirror, the image of the same size seem to form behind the mirror. This happens because the light from the object is reflected by the mirror and enters your eyes. The reflected rays seem to come from an image behind the mirror. However, if you place a screen at the position where the rays seem to be coming from, you will not see an image on it. Such an image that cannot be formed on the screen is called a virtual image.




It is possible to locate the position of an image by a plane mirror by tracing the rays or making a ray diagram.

A source of light O is placed is front of a plane mirror AB. Two incident rays OP and OR are falling on the mirror. Draw the reflected rays PQ and RS. Extend them backwards and mark the point I where they meet. When your observe at point E, the reflected rays appear to come from the point I Thus a virtual image of the point O is formed at I.

If you hold your right hand up before a mirror your image will show your left hand up. This interchange of left and right between an object and its image is called Lateral Inversion. Thus image formed by a plane mirror is

- Virtual
- Erect
- Of the same size as the object.
- At the same distance from the mirror as the object
- Laterally inverted

## Activity :

*Objective :* To show that the image formed by a plane mirror undergoes lateral inversion.

*Procedure :* Looking into a plane mirror like the one at home. What will you notice? Your image will appear the same size as you. But on raising you right hand, your left hand is seem to be raised. This is lateral inversion. Why do the

ambulances has the words on its front written inverted? This is so because the driver of the vehicles in front of the AMBULANCE can see in their rear view mirror and make way for it.

## LUMINOUS AND NON-LUMINOUS BODIES :

### Sources of light and visibility

All luminous bodies are the sources of light. Sun emits light – it is a luminous body. It is day when sun rises. Flame from the fire, Candle and the lamps are the source of light for us. The objects which do not emit light of their own are the non luminous objects. Non Luminous objects are seen only when light falls upon them. The moon that we are able to see at night actually reflects the light of the sun to us.

The process in short is, when rays of light enter our eyes, they fall upon a light sensitive layer of the eye – The Retina. The sensation is sent to the brain through the optic nerve. The brain interprets the image formed on the retina. This is how seeing happens.

### Multiple Reflections

On visit to a barber's shop for hair cut, he shows us the back of your head by holding a mirror in his hands and keeping it facing our back. We are then able to see the back of our head in the front mirror fixed on the wall in front of our face. The explanation is, the mirror kept at our back reflects the light from the back of our head and forms an image of our back in it. The light, reflected from the back mirror falls on the front mirror. This again reflects it and forms an image of the back mirror as well as the image of the back of our head in it.

It is this image of the back of our head (formed in the back mirror) that we are able to see in the front mirror.

### Activity :

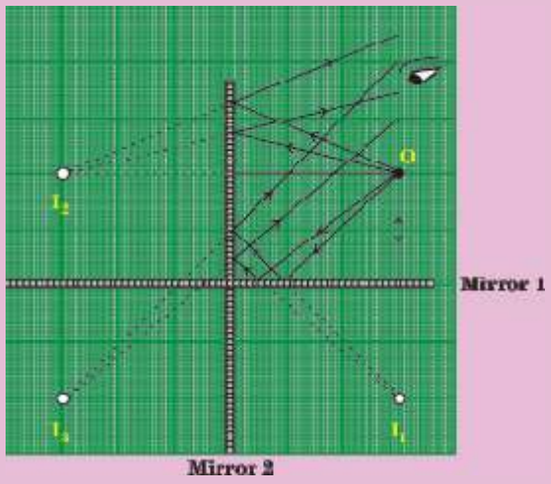
*Objective :* To show that many images can be seen when two mirrors are placed inclined to each other.

*Procedure :* Place two mirrors at right angles to each other. You will see three images formed as shown in the figure.

*Observation :* Mirror 1 makes the image I, of the object O

Mirror 2 makes image $I_2$ of the object O

The third image of the mirror 2, or in other words image $I_2$ is the image of mirror 1.

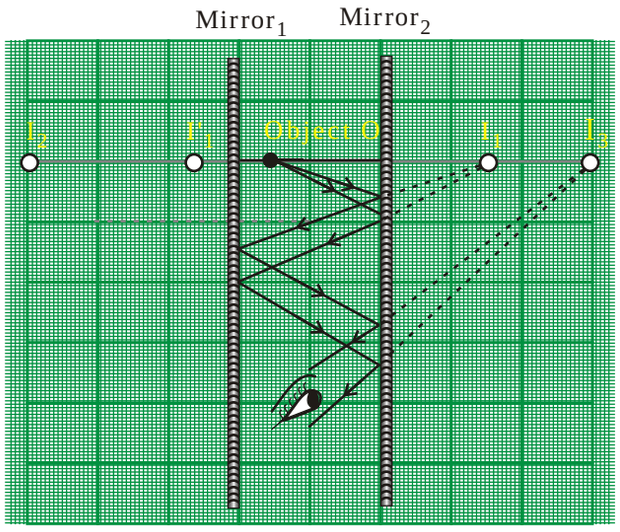



*Explanation :* Here, the image formed by one mirror acts as an object for the other. The angle at which the two mirrors are placed, decides how many images can be produced. The number of an images of an object placed between two mirrors can be found from the following formula.

$$\text{Number of images} = \frac{360°}{\text{Angle between mirrors}} - 1$$

**Two Mirrors Placed Parallel to each other :** If an object is placed in between two plane mirrors parallel to each other –

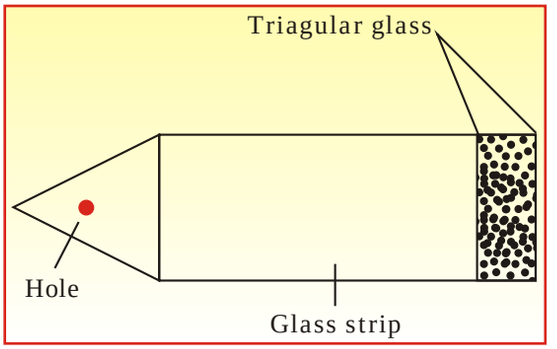
- Image of object in mirror 2 is formed at $I_1$, as far behind the mirror as in front of it.
- Image $I_1$, acts as an object for mirror 1 and its image is formed at $I_2$
- The image $I_2$ acts as the object for mirror 2 and its image is formed at $I_3$.
- Infinite number of images are thus formed by the continuation of image formation in the mirrors, though the images keep on becoming dull.




## Kaleidoscope

Kaleidoscope is a kind of toy which children play with by peeping through it and enjoy different coloured patterns of glass or plastic pieces. It can be easily

made by simple materials. Kaleidoscope is based on the principle of multiple reflection using a set of three mirrors inclined at 60° to each other.



*Kaleidoscope (side view)*

## Method of making kaleidoscope :

Take three thin strips (15 cm x 5 cm) of mirror and fix them to form a triangular tube using an adhesive tape. Use a triangular transparent glass/plastic piece to close one of the ends of the triangular tube. Cover the triangular tube with card sheet rolled over in such a manner that the triangular tube is about 0.5 cm inside from one of the ends of the card sheets. Next, place some coloured broken glass or plastic pieces on the transparent glass cover of the triangular tube. Cover this with another glass piece and paste it firmly to the outer card sheet jacket. Close the other end of the card sheet jacket with a thick paper. Make a peep-hole in its centre. The Kaleidoscope is ready.

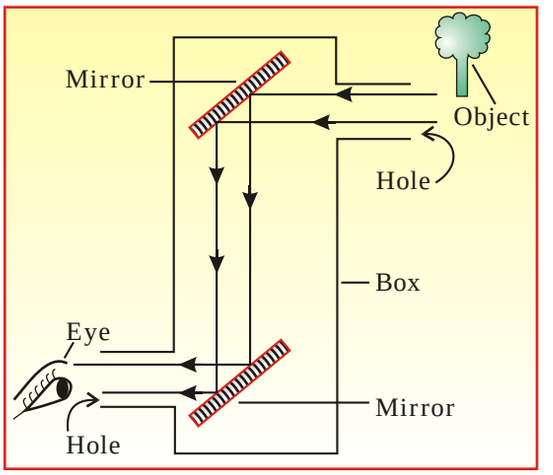
On viewing through the peep-hole of the Kaleidoscope facing light, one can see beautifully coloured patterns which change on rotating the tube. Designers use this for creating designs.

## Periscope :

Principal of reflection by plane mirror is applied in the working. Periscopes are used to see objects which are not in line with sight. Mariners use this to see ships on the sea from a submarine.

## Making of a Periscope

Take a long card sheet box. Make two slits at ∠ 45°, one at both the ends of the box. Insert mirror strips through each slit. The mirrors should have their reflecting surfaces facing each other. Make a hole in front of each of the mirrors.



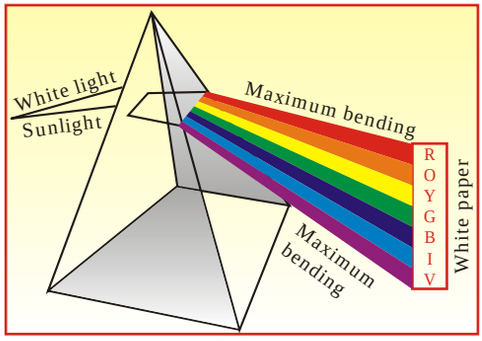
If you look through one of the holes, you can see the objects in front of the other hole which are not in line with the eye.

## Dispersion of Light

It is a beautiful sight that appears in the sky just after a shower of rain and sun comes out. They are also common sight within the spray of water falls. Sometimes, rainbow colours are also seen on soap bubbles, oil film on the surface of water or on a CD. What is this phenomenon?

*Rainbow*

When a narrow beam of light is allowed to pass through a prism, it splits into seven colours. The process of splitting of white light into its seven colours is called as dispersion of light. The band of colours produced when white light is split up is called the spectrum. The spectrum has seven colours – violet, indigo, blue, green, yellow, orange and red. This is called VIBGYOR. These are the colours that we see in rainbow.




*Prism*

## Activity :

*Objective :* To see the colours in white light.

*Procedure :* Take a tray or a shallow pot and fill it with water. Keep a plane mirror in a tray filled with water at a suitable angle. Make sure that the incident ray of light or sunlight passes through the water gets reflected by the mirror and falls on the sheet of white paper or a white wall. The path of reflected rays of light is stopped by this white paper or wall.

*Observation :* It is observed that a band of colours starting with red light at the top then orange, yellow, green, blue, indigo and violet is formed on the white paper on the wall. This happens because the mirror kept at an angle and water together work like a prism and the white light dispersed into seven colours. Dispersion of light by violet is most deviated and red the least.

## Activity :

*Objective :* To observe VIBGYOR through a prism

*Procedure :* Let a beam of light (sunlight) fall on one of the faces of transparent glass prism. Let the emerging beam fall on a white sheet of paper placed opposite to the other side of the prism. A beam of seven different colours is seen to fall on the paper. The colours is seen to fall on the paper. The colours are in the sequence of VIBGYOR making a spectrum.

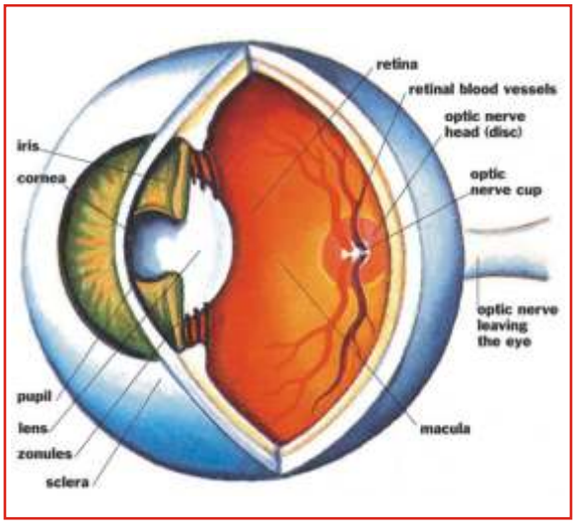
*Explanation :* The light of different colours travel with different speeds. The violet light travels slowest and the red fastest. So, the red light bends least and violet the mot mentioned earlier. Dispersion is due to the refraction of different colours at different angles Issac Newton obtained spectrum of sunlight first. Rainbow is formed due to just after rains, due to the refraction of sun rays through suspended rain drops which act as little prism.

### Human Eye :

Human eye is an important organ of our body which enables us to see the world around us. Human eye resembles a camera in many ways Eye lids protect the eyes. They also stop the entry of light when not required.

**Structure of the Eye :** The eye is almost spherical in shape. The tough white outer coat of the eye protects the inner part of the eye from injury. Its front part is made up of transparent material and is called Cornea. A dark muscular structure called Iris is present behind the cornea. There is a hole in the centre in Iris, is called as Pupil.

**The Iris** adjust the amount of light entering the eyes by altering the pupil due to the muscles. It is the iris which gives the eye its distingtive colour. A person who is 'blue eyed' means his iris is blue. In bright light, the iris expands and reduces the size of the pupil. In dull light, the iris contracts and increases the size of the pupil so that more light can enter the eye. The pupil appears black because no light is reflected from it.




*Structure of eye*

Lens : A transparent convex lens made of tough gelatinous material is present behind the pupil. The ciliary muscles surrounding the eye lens can increase or decrease the thickness of the lens, thus altering its focal length as per the need of light.

Retina : The lens forms an image of the object at the back of the eye, on a sensitive layer called Retina. The retina consists of light sensitive cells, rods and cones which receive the light stimulus and send it to the brain via optic nerve.

The image formed on retina is small and inverted which is interpreted by brain as erect and of the right size.

Aqueous Humour : The space between the cornea and lens is filled with a liquid called the aqueous humour.

Vitreous Humour : The space between the lens and the retina is filled with a liquid called the vitreous humour.

Blind spot : is the region at junction of the optic nerve and the retina having no light receptors which respond to light. Therefore, an image that falls on this region will not be seen. So, it is called the area of no vision in the eye.

## Activity :

*Objective :* To observe the size of pupil in dim and bright light.

*Procedure :* Take one of your friends in a dimly lit room. Look into his eyes closely and note the size of pupil. Now throw light into her eye with a torch. Note the size of the pupil again.

*Observation and conclusion :* When you through bright light on the eye, the size of the pupil decreases. This happens because iris change the size of the pupil to alter the amount of light entering into the eye.

## Activity :

*Objective :* To draw a blind spot tester.

*Procedure :* Make a small dot on a paper on its left side. Make a (+) sign on the right side of distance of 15-20 cm from the dot.

### Blind Spot Tester :

Close your right eye. Hold the image about 50 cm away. With your left eye, look at the (+). Slowly bring the image (or your head) closer while looking at the +. At a certain distance, you will observe that the dot will disappear from sight. This is when the dot falls on the blind spot on your retina. Reverse the process. Close your left eye and look at the dot with your right eye. Move the image closer to you till + disappears. This is called as the area of no vision in the eye. You can also find your blind spot by doing this activity.

Near point and Far point : The ability to focus the eye on nearby and distant object is called the power of accommodation. The power of accommodation is greatest in child and decreases with advancing age. The point nearest to the eye at which an object is visible distinctly is called the near point of eye. For the normal eye, the near point is at a distance of about 25 cm from the eye. The maximum distance upto which the normal eye can see the things distinctly is called the far point of the eye. It is infinity to a normal eye.

### Yellow Spot

The yellow spot Macula is a spot located in the centre at the back of the eye. It contains maximum number of light sensitive cells especially the cones. Rest of the retina has lesser cones and more rods. The yellow spot is the region of colour vision and the brightest vision.

### Persistence of vision

The image of an object does not vanish immediately from eye, even after the object in front of our eyes is removed, it stays there for about $1/16^{th}$ of a second. So, images that are observed in quick succession do not appear as separate images, rather they look like smooth moving animations. This phenomenon is called 'Persistence of vision'.

## Activity :

*Objective :* To demonstrate the phenomenon of persistence of image.

*Procedure :* Take a round piece of paper card. Make two holes opposite to each other and thread a string through the two holes. Draw a picture of a bird on one side and a cage on the other side of the paper. Hold and twist the

strings to twist the paper rapidly. Observe carefully .

*Observation and Conclusion :* when the paper card twists rapidly, it is observed that the bird is in the case. This happens due to persistence of vision.

## Defects of the vision

A healthy eye can see properly, the muscles surrounding the lens automatically adjust the thickness of the lens which enables it to for sharp image of the object on the retina whether the object is near or far from the eye. Sometimes the thickness of the lens cannot be adjusted as required for the formation of sharp images. This is Defect of Vision.

There are basically two types of defects in the human eye.

1. Myopia or short sightedness.
2. Hypermetropia or far sightedness.

1. Short sightedness : It is called as short sightedness was because the person suffering from this problem can see near by objects clearly but not far of object clearly. This can be due to elongation of eyeball or decrease in the focal length of the eye lens.

   *Correction :* By using concave lens of suitable focal length.

2. *Hypermetropia :* This is also called as long or far sightedness because person suffering from this defect can see far off objects clearly but find difficulty in seeing nearer object like finding difficulty in reading. It can be due to shorting of the ball or Increase in the focal length of the eye lens.

   *Corrections :* The defect may be corrected by using convex lens of suitable focal length .

   *Cataract :* In old age, the lens of the eye become clouded which leads to decrease in vision or foggy vision. The opaque lens is removed and new artificial lens in inserted in its place. This procedure has become safer with the advancement of technology.

   *Night Blindness :* It means you see colours differently than most people. It is mostly genetic. This is due to faulty photo pigments in the cone cells.

Care of the eyes : Eyes are very delicate and important organs of our body. They should be protected and maintained very carefully. Some steps to be taken

for eye care are follows -

- Eyes should be washed by splashing clean cold water and not rubbed with hands.
- Eyes should be protected against too strong or dim lights especially while reading, driving etc.
- Proper distance should be maintained while watching TV or working on computers and while reading.
- Diet rich in vitamin A should be taken as its good for eye sight.
- Protect your eyes from damage while playing.
- In case of any strain, consult the doctor immediately.

Spinach, milk, butter, tomato, cabbage, mangoes, etc are foods good for eyesight.

Deficiency of vitamin A may lead to eye diseases like the night blindness.

## *Visually challenged people :*

There are about 253 million people in the world who are visually impaired. Unfortunate visually impaired or blind people have a tough life without the sense of sight but the have otherwise high IQs and remarkable sense of touch and are very talented. They can be helped be pledging to donate eye (cornea) after death by healthy people or make them learn a special writing system called the Braille System. Visually challenged people use sticks to walk, they develop a strong sense of sound and touch.

*Braille System*

## Braille System

It is a method of writing for the behind invented by a young Frenchman in 1800's, named Louis Braille who himself was visually challenged. The Braille system involves a method using special symbols representing the alphabets and their combination.

The symbols consist of up to six dots, two dots horizontally and 3 dots vertically in a rectangular array.

The dots are slightly raised (embossed) above the surface of the paper. These array of raised dots is called a Braille cell. This six dot code system is used by blind people by gliding fingers across these raised dots.

Some important visually challenged people :

*Ravindra Jain :* Was blind by birth, was a renowned lyricist, singer and music composer of India.

*Hellen A Keller :* was the most well known and inspiring visually impaired person. She was an American auther and lecturer. She lost her eye sight when she was only eighteen months old. She was the first deaf blind person to earn a bachelor of arts degree. She wrote many book and articles.

## Keywords :

| | | |
|---|---|---|
| reflection of light | : | bouncing back of light after striking a surface. |
| incident ray | : | ray of light falling on a mirror. |
| reflected ray | : | ray of light bouncing away from a mirror after reflection. |
| normal | : | a line drawn perpendicular to the reflecting surface. |
| angle of incidence | : | the angle between the incident ray and the normal. |
| angle of reflection | : | the angle between the reflected ray and the normal. |
| virtual image | : | the image that cannot be formed on a screen. |
| regular reflection | : | reflection from a smooth surface. |
| diffused reflection | : | reflection from an uneven or rough surface. |
| multiple reflection | : | the phenomenon in which multiple images of an object are formed because the image formed by one mirror acts as an object for the second mirror. |
| dispersion | : | splitting of white light into its component colours (VIBGYOR). |
| aqueous humour | : | the liquid filled in the space between in the cornea and the lens. |
| vitreous humour | : | the liquid filled in the space between the lens and the retina. |
| persistence of vision: | | the phenomenon in which the image of the object stays on the retina for 1/16th of a second even after the object is removed. |
| myopia | : | a defect of vision in which a person can see the nearby objects clearly but cannot see the nearby objects clearly. |
| hypometropia | : | a defect of vision in which a person can see the distant objects clearly but cannot see the nearby objects clearly. |
| cataract | : | the clouding of the lens of the eye in old age. |

## Summary :

- Are able to see things because of sense of light.
- Light can see things when light reflected from a body falls into our eyes.
- Rebounding of light from a surface is called reflection of light.
- Materials can be transparent, translucent or opaque.
- Polished surfaces reflect back almost all the light falling on it. eg. a plane mirror etc.
- Well defined images are formed due to regular reflection eg. plane mirror. When light falls on a rough surface, a hazy vision is there-called the irregular reflection.
- Laws of reflection are :

  (i) incident ray, reflected ray and normal all lie on the same plane.

  (ii) angle of reflection is equal to the angle of incidence. ie. < i = <r.
- The image formed by a plane mirror is virtual, erect, of the same size as the object, laterally inverted.
- Luminous body are the source of light. Sun is luminous body. Non-luminous body are does not emit limit on their own, seen only when light falls on it. eg. moon.
- Multiple reflection is used by barbers using two mirrors, one in front, one at the bulk, one can see the back of the head or hair.

  Two mirror kept parallel to each other-infinite number of images are formed by continuation of image formatiom. Kaleidoscope: a toy to enjoy coloured patterns by peeping through constructed based on the principal of multiple reflections.
- Periscopes are used to see objects which are not in line with sight based on the principal of reflection by plane mirror. Mariners use this to see ships on the sea from a submarine.
- When a mirror beam of light is allowed to pass through a prism, it splits into seven colours. This is called dispersion of light. The band of seven colours is called spectrum having seven colours. VIBGYOR – Rainbow colours.
- Human eye allows us to see, has cornea, iris having hole-pupil, lens, retina, aqueous humour, vitreous humour, blind spot, yellow spot.
- Defects of vision are Myopia, hypermetropia, cataract, night blindness, colour blindness.
- Braille system involves a method using special symbols representing alphabets. System consists of dots raised a bit.

# Exercise

## A. Multiple choice questions (MCQs) :

1. The rays of light which bounces back from the mirror is called :
   a. incident ray ☐ b. reflected ray ☐
   c. emergent ray ☐ d. normal ☐
2. The transparent covering of the eye is :
   a. Iris ☐ b. retina ☐
   c. pupil ☐ d. cornea ☐
3. The coloured light rays which bends least in prism is:
   a. red ☐ b. blue ☐
   c. violet ☐ d. orange ☐
4. The person who funds difficulty in seeing distant objects clearly suffers from :
   a. Hypermetropia ☐ b. Myopia ☐
   c. Cataract ☐ d. Night blindedness ☐
5. The most comfortable distance at which one can read with a normal eye is about :
   a. 20 cm ☐ b. 22cm ☐
   c. 25cm ☐ d. 30cm ☐

## B. Fill in the blanks :

1. _____ is based on the principle of multiple reflection using a set of three mirrors inclined at 60° to each other.
2. _____ image can be obtained on the mirror.
3. Line perpendicular to the surface of mirror is called as_____.
4. According to the laws of reflection the angle of incidence is equal to the angle of _____.
5. _____ spot is the area of no vision in the eye.

## C. State True or False :

1. Infinite images are formed when two mirrors are placed at right angles to each other. ☐

2. Pupil regulates the size of Iris.
3. Splitting of white light is called dispersion of light.
4. The image is our face in a plane mirror is an example of real image.
5. The region between cornea and lens is filled with a fluid called the aqueous humour.

D. Answer the following questions in short :

1. Differentiate between regular and diffused reflection.
2. State the laws of reflection.
3. Give reason – object cannot be seen in total darkness.
4. Differentiate between real and virtual image.
5. Differentiate between Myopia and hypermetropia.

E. Answer the following questions in detail :

1. Describe the construction of kaleidoscope.
2. Describe the phenomenon of dispersion of light. Give the activity to demonstrate the phenomenon.
3. Write and activity to verify the laws of reflection with figure.
4. Explain persistence of vision. Demonstrate with activity.
5. What is Braille system?

## Activity :

Explain the spectrum obtained on a white sheet of paper using a plane mirror inclined on a water surface at a certain angle.